Midwest Engineer

WESTERN SOCIETY OF ENGINEERS FOUNDED 1869

TECHNOLOGICAL MANPOWER
IN WESTERN EUROPE — PAGE THREE

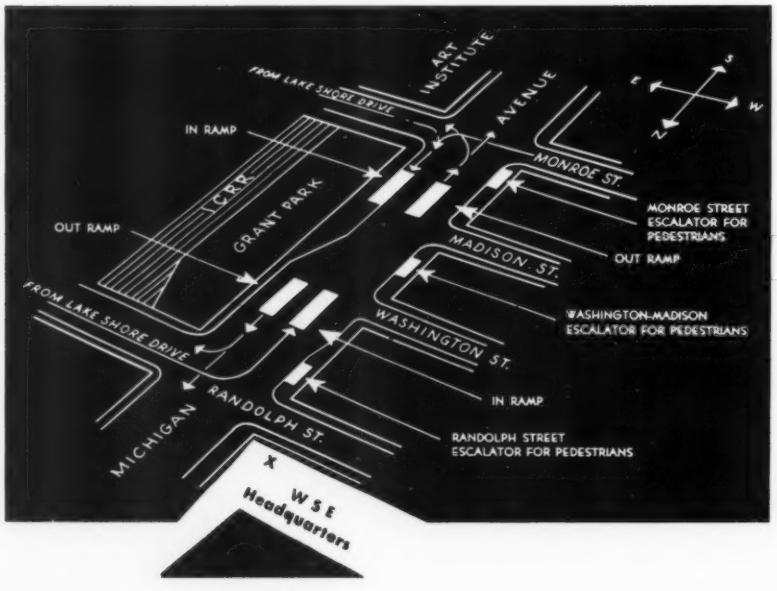
Vol. 10 FEBRUARY, 1958 No. 9

SAY, ENGINEER!

Do you like to DRIVE?

Then why not drive to WSE meetings and other functions? There's plenty of PARKING almost at the door—the Underground Garage is diagonally across the street from WSE Headquarters (see the map below), two private garages are a block west, and the State-Wacker "Bird Cage" Garage is only a short distance away.

Below: map showing Park Department Underground Garage



Interior view of Underground Garage

If you're not driving it's still convenient to get to and from WSE meetings.

Here are handy stations or stops:

- The Cab Stand is just across the street
- The Elevated is one block west
- The Subway is two blocks west
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- The IC Suburban station is across the street
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CAPACITY The garage with its 2359 parking spaces, is designed to prevent overcrowding.

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CONTENTS

COVER STORY

Here is a scene soon to be common in Northern Illinois. We are looking west on contract section N-4A of Northern Illinois Tollway, near Marengo. Aggregate trucks in the foreground wait to load the skip (uplifted) of a Rex paver, as a worker (left) checks placement of welded wire-fabric reinforcement. First a five-inch lift of concrete is placed. Steel fabric is then positioned. A paver (background) now deposits the top five-inch course of concrete which is struck off by a Blaw-Knox spreader. Reinforcement 6x12-1/1, weighing 69 pounds per hundred square feet, adds service life to the pavement and helps to keep it smooth and uncracked under heavy traffic. Two side by side lanes of concrete are tied together by 24-inch long, ⅝-inch round deformed bars, placed across the top of fabric sheets (see left of worker). Ryan Construction Company, Evansville, Ind., (with M. J. Boyle & Co., Chicago) holds contract for this section; Casler, Stapleton, Brown & Blauvelt are contracting engineers. This work is being done under the jurisdiction of George L. Jackson, immediate Past President of the Western Society of Engineers. This picture was taken Oct. 8, 1957.

Two

Field Trips

in March

March 12
NBC Color Studios

The first tour sponsored by WSE will be a tour of the NBC Studios. This tour will begin promptly at 7:00 p.m., March 12 on the 19th floor of the Merchandise Mart Plaza. There will be a limit of 200 people at the NBC tour. Make your reservations the first!

March 22
New Sun-Times Building

The second tour will be of the new Sun-Times Building. It will begin at 1:00 p.m., March 22. The building represents the latest in architecture and design and incorporates a number of novel structural advances. You are sure to find this a most interesting and enjoyable experience.

Call Western Society at RA 6-1736 to be included in both of these unusual tours.

In Western Europe

Technological Manpower

By Dr. Dael Wolfe

The United States is far from being alone in exhibiting a lively interest in the supply and utilization of scientific and engineerng manpower. In recent years, and especially since the publication of Nicholas DeWitt's book, *Soviet Professional Manpower*, much attention has centered on the rapidly increasing supply of scientists and engineers in Russia. The spectacular achievement of the space satellite has heightened this interest, and has resulted in uncounted inches of newspaper space comparing Russia and the United States in terms of numbers of scientists and their achievements, their incomes, and the conditions affecting their work.

Russia's educational record and technological achievements have undoubtedly been the most effective single factor in stirring public concern in the Western World over our own supply of scientists and engineers. It may, in fact, turn out to be true that *Sputnik* is a greater stimulant to American science and technology than have been any of our own achievements. While we can capitalize on this situation, we must remember that there are more basic reasons for seeking to improve education in the sciences and to increase the number of trained scientists and engineers. The technological civilization in which we live demands more knowledge of science on the part of every educated person and requires more scientists and engineers than has ever been true in the past. These changes characterize the Western European countries as truly as they do the United States. Great Britain recognized this situation perhaps earlier than any of the other Western European countries, and toward the end of World War II began the systematic study of its own scientific personnel resources, its educational system, and the changes in the educational system necessary to meet anticipated future demands. More recently, most of the other countries of Western Europe have developed similar interests. While no other country has devoted so much effort to the study of its technological manpower trends as have Great Britain and the United States, it is nevertheless true that West Germany, France, the Netherlands, Norway, Sweden, and some of the other countries of Western Europe have recently completed, or are in the process of making, projections of their scientific and engineering manpower supply and demand trends.

Not only are the individual countries engaged in such studies, but so also are some of the international organizations representing Western Europe. Under the chairmanship of Professor Joseph Koepfli of California Institute of Technology, NATO currently has an active working group investigating the problems of scientific research and manpower that are of interest to the Western European countries. The Organization for European Economic Cooperation, which in its membership fairly closely parallels the NATO countries, but is organized for economic rather than military cooperation, has held several conferences on scientific manpower in the member countries, has published two detailed surveys of engineering and scientific manpower in those countries, and has a very able working party mapping out a program of studies and activities that can appropriately be carried out on an international basis.

Last May and June the Organization for European Economic Cooperation sent a group of four consultants to a number of the Western European countries to discuss technical manpower problems and the ways in which each country could best meet its technological needs. I had the privilege of serving as a member of this commission, and had as colleagues Mr. George Bosworth, an engineer who handles the recruitment and training of scientists and engineers for the English Electric Company; Professor Louis Weil, a physicist from the University of Grenoble; and Mr. Toralf Hernes, an engineer who is a member of the Royal Norwegian Council for Scientific and Industrial Resarch. We visited France, England, the Netherlands, Norway, Sweden, Denmark, Germany, and Italy, and in each country held discussions with the ministries of labor and education, industrial leaders, heads of universities, and sometimes also with representatives of professional engineering societies, labor unions, and other groups with an active interest in technological manpower. I have no intention of detailing our findings in each country or the effort that each country is making to meet its anticipated needs for technologists. Instead, I would like to pick out for specific mention three points that arose again and again in our discussions, and that represent problems of wide and basic concern to the Western European nations. These problems transcend the individual characteristics of the social, economic, or educational systems of a given country, and are, in fact, as important in the United States as in the European countries.

The first of these problems is the question of numbers. In every country we visited, we were told that more scientists and engineers were needed. But most of our consultants went on to

Dr. Dael Wolfe, executive officer, American Association for the Advancement of Science, Washington, D.C., presented this talk at the Conference on Engineering and Scientific Education on October 31, 1957, in Chicago. The Conference was under the local sponsorship of the Western Society of Engineers.

stress the importance of having a proper distribution of technological talent and of having an appropriate number of persons at each level. This problem was sometimes described as the necessity of having a pyramid of talent with a number of highly able and well-trained leaders for research and developmental activities, a substantially larger number of rank-and-file technologists, and a still larger number of technicians. In some countries, there is a serious imbalance in the distribution of technological talent, for in some countries there is a serious discrepancy between industrial needs for a gradation of talent and an educational system that produces a relatively small number of very highly trained scientists and engineers and a much larger number of technicians and craftsmen, with comparatively few in between. In Germany, for example, we were repeatedly told that some engineering graduates of university grade were being used for less exacting jobs simply because there were not enough men of secondary engineering level for the necessary supporting roles. The same problem was mentioned by leaders of scientific industry in France, the Netherlands, and elsewhere.

With the wide consciousness of this problem, a number of efforts are being made to solve it. As Mr. Hiscocks has told you, the development of the technical colleges, of sandwich courses, and a widespread industrial effort to provide technological training for able young workers who have joined industry at an early age, constitute an effective method of meeting this problem in Great Britain.

In other countries, other efforts are being made. In some of the continental countries—the Netherlands, for example—there is no degree and no socially acceptable stopping place on the educational ladder between completion of secondary school and attainment of a degree that in the United States or Great Britain would rank at the graduate level. This fact, coupled with the great amount of freedom given to students to delay presenting themselves for examinations until they feel fully prepared, has resulted in a prolongation of university work to the point where the average student enters at about age 20 and does not receive his degree until he is almost 30. To help meet this situation, the Netherlands this fall opened a new engineering school at Eindhoven, which its sponsors hope will resemble more closely the better engineering schools in the United States, and in which students will receive their degrees after an average of about five years of university work. The Dutch authorities hope that successful achievement of such a schedule at Eindhoven will force comparable changes in the famous older engineering institution at Delft.

Another new engineering school that is holding its first classes this fall is at Lyons in France. It is specifically designed to provide a less extensive engineering training than the older French Grande Ecole and to provide a supply of practical engineers for French industry.

A new curriculum is being started in Denmark; and elsewhere in Europe comparable efforts to fill in the gap between the very highly trained research

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and development technologist and the technician level are being instituted.

As a possible additional method of meeting this problem, considerable thought is being given to the usefulness of a tighter university organization, so that students have intermediate examinations at more frequent intervals and have less opportunity to delay inordinately the receipt of degrees. One method that may be useful in this connection is the development of better counseling and guidance practices. I would not, however, expect very rapid progress in this direction, because the traditions of complete freedom and independence that characterize European higher education are very strong, and because most of the professors and educational authorities grew up under and are accustomed to and like the older system. Nevertheless, one of the changes that must inevitably come is the adoption of arrangements for the production of a larger number of rank-and-file engineers. Industry needs such men, and recognizes the need. The educational systems will have to be modified to fill that need.

The second point of widespread agreement that I would like to mention is the necessity of improving the quality of science education. One frequently mentioned aspect of this problem was the importance of providing education for breadth and flexibility. Let me introduce this problem with a quotaton from an American rather than a European source. Clarence H. Linder, vice president of General Electric Company, last spring told the participants in the Thomas Alva Edison Foundation conference on cooperative education that "Any attempt to produce specialists and a high degree of competence in depth in four years is a waste of time. It simply cannot be done. . . . The more and sooner we recognize that the four-year curriculum should concentrate on basic fundamentals which are common to many fields of engineering rather than on specialized practices within each field, the better off we are going to be on the road to the future."

The same point was made by industrial leaders in the conferences we held in Western Europe. In Great Britain, for example, there were frequent charges that technological education was overspecialized, that university entrance requirements forced too much specialization upon students in the later years of secondary school, that the university graduate attained a high level in the field of his special choice, but did not have a broad enough educational base. Admittedly, this is a difficult matter to handle, for I suppose the ideal engineering school graduate would bring to his first job both a high level of attainment in all fields of engineering and a broad foundation in the basic sciences upon which those fields rest. The impossibility of attaining this ideal is, however, widely recognized, and a number of attempts are being made to revise educational programs. In Great Britain, the new College of North Staffordshire gives exactly the same curriculum to all first-year students, and provides much less specialization than do the older British universities. A new program combining science and humanistic studies for students who are likely to enter careers of administration and public service is being developed at Oxford. There are other plans afoot to permit students in the technological fields to spend a larger

(Continued on Page 18)

Needles becomes EJC President

Enoch R. Needles made the following remarks on assuming the office of president of Engineers Joint Council, on Jan. 10, 1958:

It is my very great privilege and a very high honor to appear here before you. Engineers Joint Council is an assembly or union of engineering societies. In my judgment, it cannot serve as merely another society, or take over the place of an existing, functioning society. All of the societies which go to make up EJC are established and going concerns in their own particular fields. They have long since justified their existence and are proving their worth in the judgment of their members. EJC serves best as a common meeting place for the authorized representatives of these societies, and a means for strong, united expression of views to our fellow men in respect to the common problems of our great profession.

All of us have been critical of EJC in one way or another during the past few years of its existence. Most of our criticism has been constructive. In many ways the past years have been primarily formative, and the most productive future of EJC lies still ahead.

But to me EJC has already become productive. Its principles have gained the support of fifteen engineering organizations representing some 250,000 individual engineers. This evidence of approval is truly and completely impressive. I could talk at great length of the important work and of the many significant accomplishments of EJC up to this day.

One of the finest conceivable developments has been the spirit of unanimous approval which appears undeniably evident in all of our societies toward our new United Engineering Center to be constructed adjacent to United Nations Plaza. The securing of adequate funds to complete this notable tribute to our modern and comprehensive engineering profession seems to me to be assured, and I have the idea that the unity of action necessary to do this job could not now begin to be possible if EJC had not been in existence during the past ten years or so.

What is ahead for 1958? The challenges and opportunities before us in the coming year are without precedent. Of continuing interest is our endeavor toward complete unity in EJC on the part of all of our major engineering organizations. I hope that we may see our greatest wishes realized during 1958. The possibilities of rather complete unity within EJC do not appear out of reason.

We have the continuing job of supporting and furthering the best interests of Engineers Council for Professional Development, especially in the vital field of accreditation of engineering curricula. We will continue our endeavors toward bringing about a comprehensive survey of the engineering profession. In the light of international developments in recent months, the characteristics and purposes of this survey may be greatly clarified.

Of tremendous continuing importance is the work and position of our Engineering Manpower Commission. To me, the importance of this Commission is greater than ever before, and we must all agree that this work must not suffer in any way through lack of finances. If the engineer is ever to have a voice to be heard by his fellow man, this year of 1958 is clearly the time.

Our National Engineers Committee will surely have very important things to do this next year. Possibly this Committee and our Engineering Manpower Commission can help to offset some of the political propaganda, research and tests by radio, television and headlines, and hysteria brought on by demagogues, to which our people have been ad nauseam in recent months.

I believe there are some things on which we of the great engineering profession have both the right and the obligation to express our judgment and views during 1958. Who could speak better? Numerous plans are now being presented to produce revisions in our educational processes, all being slanted specifically toward the education of our future engineers and scientists. In the minds of many, the program of greatest excellence must be the one which costs the most money. The idea appears to be that if we increase the quantity of our engineers and scientists, the desired quality will follow automatically. Apparently our greatest engineers and scientists of the future are those who heretofore could not get past high school because of lack of scholarships. If some of the proposed plans go into effect, we may never have a future shortage of so-called engineers and scientists, but there may also be a very serious question as to how well compensated our engineers and scientists of the future can become in the face of a glut of mediocrity. We engineers can well give

thought to what we should say for the greater good of our nation; and then say it!

The situation in which we find ourselves is not the result of technological failure. It is rather the result of mistaken decisions in program emphasis and manpower administration during the past decade. To ascribe the Russian rocket and satellite lead to weakness in American technology is misleading and erroneous. There is no evidence to indicate that the "race" is temporarily lost for technological reasons.

There is no question but that any one of several engineering and scientific organizations could have won the race to get an earth's satellite into the air if this had been considered of prime political significance, and if this was to have been used as the basic measure of our technological excellence. We have not lost our technological leadership or engineering productivity, but we must push everlastingly forward in our educational processes for engineers and scientists and the orderly and intelligent administration of their endeavors and services.

We recognize that educational reform can have absolutely no effect on our technological performance during the crucial next three years when our technical accomplishments must be truly in keeping with our great capabilities to restore the temporarily dimmed prestige of the U.S. The first step the country must take is to provide adequate administration and direction for the technological team of scientists and engineers which exists. There is no reason why the U.S. cannot have, at one and the same time, a continuing rise in the living standard and a defense capacity of ever-increasing strength.

What is the engineer going to say as a result of the Special Studies being made possible through the Rockefeller Brothers Fund?

Should not the many societies which make up EJC be encouraged to express their views to the appropriate committees in EJC relative to these questions of national import, so that the voice of the Engineer can truly and clearly be heard in our land in the year 1958?

Surely the year 1958 is a year of challenge and opportunity for Engineers Joint Council.

Foreign Nuclear Market is Large

Overseas nuclear development offers United States technology a $3 billion market for goods and services over the next decade, according to a survey by Vitro Corporation of America.

"Most overseas nations are now in the early phases of their nuclear development programs. Some of them are faced with an immediate need for nuclear power and cannot afford the time to develop technological capabilities for commercial nuclear power. They must rely on U.S. nuclear know-how and equipment to fill the gap," says Ralph L. Brown, vice-president of Vitro International.

A Vitro analysis of nuclear needs outside the United States through 1967 shows a $3,115,000,000 total potential market in nuclear reactors for power, propulsion and research, radioisotope applications and engineering services. Power reactors and associated hardware present the United States with the most immediate and definable market for nuclear products overseas. The market is broken down this way:

$2,000,000,000	—power reactors and related equipment
1,000,000,000	—propulsion reactors
30,000,000	—research reactors
10,000,000	—radioisotope and radiation applications
75,000,000	—engineering services
$3,115,000,000	—Total Potential Market

"There are many obstacles and factors that will affect the measure of our success in supplying these markets. For instance, we can expect continuing stiff competition from Britain's growing nuclear industry. We can also expect that some more advanced nations will turn to the licensing as a means of getting their own programs under way at an earlier date. However, there is little doubt that the international market will provide a significant outlet for U. S. nuclear products and talents.

"We are confident that American industry is equal to the challenge. By assuming a vital role in nuclear development overseas, American industry can enhance its capabilities to satisfy the coming needs of our own nuclear program, produce profits which otherwise might be lacking during this period and meet responsibilities under our Atoms for Peace program," Brown said.

Vitro International is an operating company, formed in December, 1957, by Vitro Corporation of America, to represent all Vitro operations overseas. The company is responsible for overseas sales of all Vitro operations, licensing of Vitro techniques overseas, and the licensing of techniques for Vitro activities in the U. S.

Vitro International will engage abroad in all activities currently associated with Vitro Corporation of America in the fields of nuclear energy; nuclear materials; chemical, metallurgical and petroleum processing facilities; mining and extractive metallurgy.

Vitro is currently engaged in design, engineering and construction of three major foreign projects. They include a nuclear test facility at Milan for the government of Italy, a heavy water-fertilizer plant for the government of India at Nangal and a large nuclear power station for SIMEA, near Anzio, Italy's famed World War II beachhead. The station will produce 150,000 kilowatts.

Rolling Tire Bags Hold Gasoline

An unusual new rolling fluid transporter, whose 10 huge rubber tire bags towed by a pillow-tire FWD Teracruzer can transport 5,000 gallons of fuel or other liquids over terrain inaccessible to conventional tank trucks, has been developed for the Army's Transportation Research and Engineering Command by the Four Wheel Drive Auto Company of Clintonville, Wis., it was announced Jan. 9.

The new FWD fluid transporter, utilizing containers developed by Goodyear Tire and Rubber Company, Akron, O., was unveiled in Clintonville for officials of the Army, Navy, Air Force, Marine Corps, and industry.

The transporter developed by the U. S. Army Transportation Corps by FWD has 10 fluid carriers, each 5 feet high, 3½ feet wide, and 500-gallon capacity, mounted in pairs on FWD-developed axle and towing assemblies equipped with filling and emptying and braking systems.

Overall capacity of such a fuel train, however, is limited only by pulling power of the towing vehicle and similar transporters are being developed to move more than the 5,000-gallon train demonstrated at the unveiling. Such rolling fluid transporters, designed for moving fuels, chemicals, water, and other liquids over all types of terrain, have extensive commercial as well as military applications.

By making the fluid containers their own mobile carriers, instead of transporting the load on trucks or other vehicles, the fluid transporter can move liquids over sand, mud, swampland, boulders, side slopes, hills, and rough ground as well as ice and deep snow. The result is easy, safe, and economical movement of bulk liquids under terrain and climatic conditions too difficult for conventional vehicles.

The Goodyear containers are mounted on tubular axles with wheel bearings and hub and rim mounting that allows easy removal or replacement of empty tire bags. The air-over-hydraulic brakes of the transporter assemblies are operated from the towing vehicle.

Individual manpower can be used to maneuver single transporters for short distances over level ground. The FWD-designed system empties or fills each container at a rate of 50 to 100 gallons a minute and there is also a filtering system for direct pumping of aviation fuels. Fully loaded, single tank units were dropped from a 5-foot height without damage during demonstrations.

The five pairs of containers in the Transportation Corps fuel train are fastened together by means of tow bars, lunettes, and pintle hooks. The fluid transporter can be towed by any type of vehicle which can traverse the terrain involved.

FWD has developed transporters with capacities from 140 to 1,000-gallons. These may be towed single or in tandem. Goodyear's single containers used on FWD fluid transporters range in height from 3½ to 5 feet and in width from 3½ to almost 7 feet when fully loaded. The fluid transporters can be equipped with vacuum-over-hydraulic as well as air-over-hydraulic brakes and may be filled and emptied by gravity, pressure, or vacuum systems.

Applications of FWD fluid transporters are diverse for commercial and military uses:

—Transport of large quantities of fuels for aircraft and missiles over adverse terrain to small clearings and to extend the range of track and other vehicles in military operations.

—Transport of large volumes of water for firefighting in mountainous, forest, and rural areas as well as for refinery, warehouse, and industrial plant fire protection.

—Storage and transport of liquid fertilizers and insecticides for farming purposes or of insecticides for mosquito control.

—Movement of fuel and water to construction sites over soft, rough terrain.

—Transport and storage of water supply for operating personnel in remote areas.

—General transportation of liquids over snow, swamp, and sand or over roads, improved or unimproved.

The Goodyear tire bags require no maintenance and the FWD towing assembly and frame need only periodic greasing of axle bearings and the usual periodic brake inspection. The "tires" and assemblies have resistance to a range of chemicals and fuels of up to 40 per cent aromatic content for specific applications and can be stored outside in temperatures as low as minus 80 degrees or as high as 160 degrees Fahrenheit. They can be operated in temperatures of minus 65 to plus 125 degrees Fahrenheit.

The rubber containers of the fluid transporters are similar to the low-pressure (5 to 15 pounds per square inch) Goodyear Terra-Tires utilized on FWD's famed Teracruzers, which are being used as multipurpose trucks in the ground support and launching system of the Air Force's Matador guided missile.

By putting the liquid-materials load on the ground, in an extremely low rolling resistance "tire" instead of on the back of a truck or other vehicle, the fluid transporters also make possible the use of towing vehicles for other tasks.

Speeds at which the fluid transporters can be towed depend largely upon the type of terrain being traversed. The rubber containers can be towed after removal of their liquid cargo merely by tapping them with the atmospheric air pressure which replaces the fluid or by inflating the "tire" with low pressure air or gas.

The transporters may be shipped readily by open rail car, truck, or barge with maximum safety because of their ability to withstand salt spray as well as snow and rain, cold and heat. They also are air transportable and can be para-dropped and towed from the drop zone by the using vehicle.

Sweet Idea

A patent application is in for chocolate-colored paper cups impregnated with chocolate flavor, reports *Food Engineering*. Filled, the cups produce instant chocolate flavored drinks.

Nuclear Progress Report to be Featured

A progress report on nuclear developments in the electric power industry will be among featured discussions at the 20th annual American Power Conference to be held at the Hotel Sherman, Chicago, on March 26-28.

Executives of a number of electric utility companies, at a forum on March 26, will describe the current status of the various nuclear reactor projects in which their companies are participating, and discuss plans for future research and development, according to Conference Director R. A. Budenholzer, professor of mechanical engineering at Illinois Institute of Technology.

The American Power Conference, which is held in Chicago each year, is sponsored by Illinois Tech in cooperation with 14 other colleges and universities and nine technical societies.

The nuclear power forum will be one of 30 sessions scheduled during the three-day meeting, which also will include a technical session on nuclear power generation.

The program will include approximately 90 papers covering a wide variety of aspects in the electric power industry and related activities. They will include addresses at luncheon meetings on each of the three days and at the All Engineers dinner on March 27.

New and exotic propellants, such as fluorine, boron compounds, and hydrazine, economics of fuel transportation, experiences in the operation of the first commercial supercritical pressure steam electric generating station, and high voltage transmission will be among subjects to be covered. The latter will be discussed by a group of foreign scientists whose countries have had greater experience in this field than has been the case in America.

In addition, one or more sessions will be devoted to discussions of the generation, transmission, and utilization of electric energy, use of pump storage for hydro-electric stations, steam and gas turbines, power plants, generators, and heating and air-conditioning.

The colleges and universities cooperating in the conference are Illinois, Iowa, Iowa State, Michigan, Michigan State, Northwestern, Purdue, Minnesota, Wisconsin, Texas A. & M., New York, California Institute of Technology, Georgia Institute of Technology, and Massachusetts Institute of Technology.

The cooperating societies besides the Western Society of Engineers, are American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Institute of Mining, Metallurgical and Petroleum Engineers, American Society of Civil Engineers, American Society of Heating and Air Conditioning Engineers, American Society of Mechanical Engineers, National Association of Power Engineers, and Engineers' Society of Milwaukee.

Tax Information from EJC and Its Counsel

The following information has been received by Engineers Joint Council, and confirmed by their legal counsel as being correct:

The Internal Revenue Service under ruling 55-4, I.R.B. 1955-1 states that a taxpayer "who gives his services gratuitously to an association, contributions to which are deductible" under the relevant provisions of the Code "and who incurs unreimbursed traveling expenses, including the cost of meals and lodging, while away from home in connection with the affairs of the association and at its direction may deduct the amount of such unreimbursed expenses in computing his net income;" subject, however, to the limitation in respect to all gifts made to exempt organizations of our type; namely, that the total amount of such gifts made in any one year may not exceed 20% of the donor's gross income for such year. This limitation means that while such expenses are deductible they are included with other gifts in computing the 20% limitation.

Science and Nature

Recently-developed components have made possible a radio thermometer, reports *Electronics*. Immediate application is to monitor the temperature at which the penguin keeps its eggs in order to find out how some animals can stand the extreme cold.

Who has the Unwritten Papers?

- **That will win Cash Awards.**
- **That will add recognition to the writers.**
- **That will enhance our Society and our profession.**

A fund of $500 is available for the 1958 Prize Paper Competition of the Western Society of Engineers.

A maximum of five prizes may be awarded, depending upon the number and quality of the papers submitted. Minimum value of the First Prize will be $150.00.

Papers must be submitted by April 1, 1958.

Winners will be announced and the prizes presented at the annual meeting of the Society in June.

Rules and requirements of the competition may be obtained by returning the coupon below or by telephone request to WSE Headquarters (RAndolph 6-1736)

1958 Prize Paper Competition
Western Society of Engineers
84 East Randolph Street
Chicago, Illinois

Please send me a copy of the Rules and Requirements for Entrants in the 1958 Prize Paper Competition.

_____
Name

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Street Address

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City and State

Portland Cement Starts Computer

The Portland Cement Association has put into operation a two-unit electronic computer at its Chicago headquarters. The "electronic brain" is being used to prepare programs for design of concrete pavements, structures, and material for design manuals. These will in turn be made available to engineers and architects, enabling them to save time and manpower in design.

The machine, a Bendix G-15D General Purpose Digital Computer and a DA-1 Differential Analyzer, has already been used to prepare design data on dowels for pavement, barrel shell roofs and box culverts. Programs are also being developed for design of prestressed bridges. using both the standard sections developed by the Bureau of Public Roads and American Association of State Highway Officials.

The computer will enable PCA to speed development of comprehensive design charts and manuals on a variety of problems in design of structures and highways. Such manuals in the past have required many months and even years of computation by PCA engineers. The computer is expected eventually to reduce such work to a matter of only weeks.

Upon completion, computer programs will be distributed through the Bureau of Public Roads, the Bendix Users' Conference and other groups and some will also be available on request. "Flow diagrams"—which set up the sequence of operations in a design problem but do not put them into the code language used in the Bendix computer—will also be made available. They will be useful in programming for other types of computers.

Purchasing Agent Requirements Noted

A successful purchasing agent needs training in both business administration and engineering, with particular emphasis on the former.

This is the conclusion reached by *Purchasing Week*, following a survey of experts on the subject.

In a report in the issue of Jan. 13, the publication finds that business administration is considered by most to be an essential requirement for the able purchasing agent, but that some education in engineering is a great asset.

Nearly all of those questioned felt a background of both was highly desirable.

Said D. O. Williams of the Federal Telecommunication Laboratories, Nutley, N. J.: "Five years ago I would have had to say business administration. Now, it would have to be a combination of both. Schooling and education in business administration should be combined with some engineering education, some background, not necessarily a degree. This is essential in the electronics industry. So many technical problems arise in research and development that a well-rounded knowledge is mandatory."

Wilson H. Oelkers, Philco Corp., Philadelphia, points out that purchasing concerns itself mainly with the commercial aspects, while engineering delves into the design and technical areas. "Frequently, negotiations are successfully consummated between buyer and seller as a direct result of engineering knowledge complementing the business background," he states.

Howard J. Heffernan of Monsanto Chemical Co., St. Louis, says an engineering background is helpful, but a commercial or business inclination, essential. "Give me a technically trained man with a strong desire to be a purchasing agent, and I will train him to be a business man. A technical education, however, requires a college program."

L. R. Bailey, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., emphasizes that the purchasing area to which a man is assigned should determine the preferred technical background. "On equipment, an engineering background is helpful; on chemicals, a chemical background," he feels. But for price-volatile commodities, the most important qualification is a sensitivity to price-affecting factors stemming in part from training in economics. Business administration training should be helpful in the broader field where specialization is not practical."

Physics Institute Starts Program

Dr. Elmer Hutchisson, director of the American Institute of Physics, announces that the Institute is embarking on a program to help improve the quality of physics taught in high school and college.

This program is being conducted in collaboration with the American Association of Physics Teachers and the American Physical Society with the support of the Fund for the Advancement of Education and the National Science Foundation.

This educational plan which has important implications for the teaching of science in America, has the following objectives:

1. To make the study of a basic course in physics a "must" for every secondary school student.

2. To encourage qualified young people to seek careers in physics.

3. To evaluate the feasibility of teaching physics to large numbers of students by the use of television and color motion pictures in spite of the great shortage of science teachers.

4. To assess the increasing need for physicists in a technological society and to strengthen physics instruction in high schools and colleges for non-science majors.

"Recent events in the scientific world, and public pronouncements by the nation's leaders, emphasize the key role of this program of the American Institute of Physics in America's educational effort," said Dr. Hutchisson.

"We are attacking the problems at the school and college level in order to develop an informed citizenry who will appreciate the role of science in a technological society. Many of the most important problems facing the voter today are grounded in science.

"The Institute feels very strongly that a well-rounded education is necessary in today's society and that such an education cannot be complete unless the school curriculum includes as much time devoted to science as is devoted to the social studies and fine arts," said Dr. Hutchisson.

"Physics is one of the mother sciences in our technological civilization. We must make every effort to attract those who are especially talented in this area to careers in science. To challenge these students to make the best use of their abilities, we must improve the quality of physics teaching at every educational level. And we have no time to lose."

In order to achieve these objectives, the American Institute of Physics has added two visiting college professors to its staff. They are Professor Grant O. Gale, on leave from the Physics Department of Grinnell College, Iowa, and Professor William C. Kelly, on leave from the Physics Department of the University of Pittsburgh.

Professor Gale is making a nationwide survey to determine how effective television and motion pictures can be used to provide physics teaching where none now exists, and to supplement and strengthen the effectiveness of present physics teachers at the school and college levels. He is also examining the objectives which the users of television and film have set for themselves in education and how well these purposes are being achieved.

Dr. Kelly, in cooperation with the American Association of Physics Teachers, a member society of the American Institute of Physics, administers a new program of visiting lecturers in physics. This lectureship program is bringing some of the nation's most distinguished physicists. including Nobel Prize Winners, to over 100 colleges which ordinarily do not have contact with these scientists.

Each visiting scientist stays several days on the campus of the college he visits so that he may give lectures, talk with students and assist faculty members with curricular and research problems.

To date, a total of 62 distinguished American physicists have signified their intention of making these visits to colleges for three-day periods. One hundred and thirty-six physics departments have requested that visiting scientists come to their colleges.

Other important activities being undertaken by Dr. Kelly are: coordination of various committees of AIP member societies concerned with physics education! encouragement of the study of physics by stimulating the growth of student sections of the AIP; increasing student memberships in physics societies; and development of regional groups of physicists.

Both Professors Gale and Kelly are studying the manpower needs now and in the future for physicists in education, government and industry. They are concerned, too, with the task of providing more incentives for scientific education and information to all students in school and college regardless of their majors or principal areas of study.

PRR Computer Called Profitable

The Pennsylvania Railroad Train Performance Calculator, in successful operation for nearly eight years, is now getting an assist from another electronic "brain," it was reported in New York on Feb. 7 at the Winter General Meeting of the American Institute of Electrical Engineers.

The calculator, which is an analog computer, "has proven to be a worthwhile and profitable investment, J. E. Hogan, PRR engineer, told a symposium on computers.

Recently the company installed an IBM digital computer to make calculations on train performance, fuel or electrical energy consumption for moving trains, and locomotive tonnage ratings, he said, adding that the computer "makes possible a further and very much greater reduction in calculating time; train performance is calculated at rates varying between 700 and 2000 miles of track per hour depending on the number of station stops, speed restrictions and grades.

"Tonnage rating calculations on the digital computer require from one to five minutes per locomotive group depending on the length of track involved and the degree of accuracy desired. A tolerance of zero to minus 3 per cent of the exact rating has been found acceptable. To obtain the same results with comparable accuracy using the Train Performance Calculator and including the additional time required for manual preparation of data for each calculated run requires at least one man-day. To do the work with slide rule and desk calculator, the time required would be prohibitive.

"Because of the great reduction in time, the use of the digital computer has been found advantageous in calculating train performance and locomotive tonnage ratings. Being a general purpose machine, it can be used for a great variety of other data-processing work. It is expected that these newly developed uses may suggest other time-saving applications."

Computers Better Electrical Apparatus

The "marriage" of digital computers to electrical apparatus design has already achieved many technical and economic benefits and promises even more important results in the future, the Winter General Meeting of the American Institute of Electrical Engineers was told in New York on Feb. 7.

P. A. Betti, W. J. Cuthbertson and S. B. Williams of the General Electric Company, Pittsfield, Mass., discussed the "Philosophy of Applying Digital Computers to the Design of Electrical Apparatus" before a session on computers in design at the Hotel Statler.

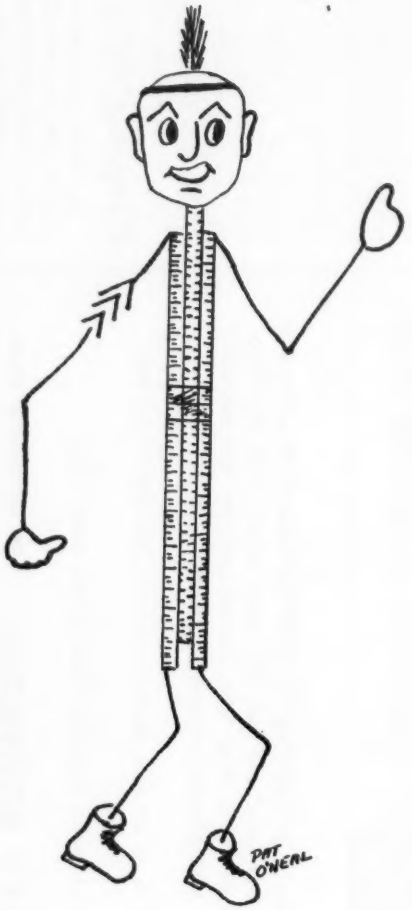
"The present and future benefits of applying digital computers to the design of electrical apparatus," they said, "can be summarized in terms of lower costs, improved quality, faster and better service, more interesting and rewarding jobs, increased productivity, and more creative effort from the engineering personnel."

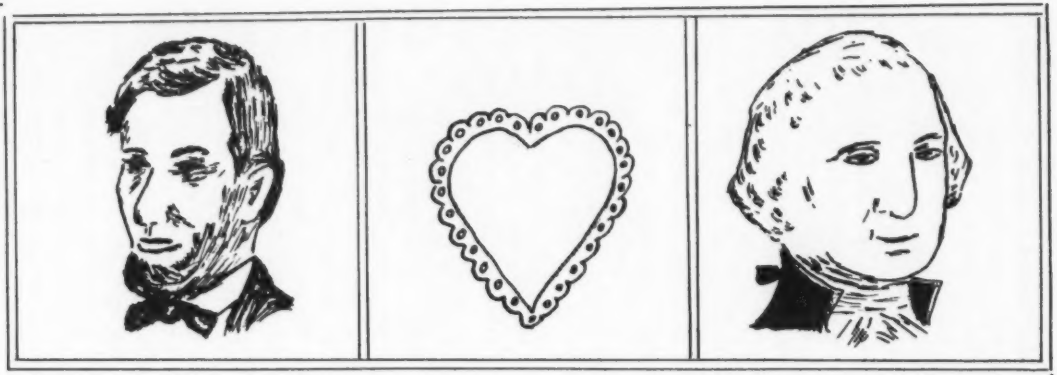
The authors pointed out that "both electrical design and computer applications are quite new among the applied sciences." Electrical design is hardly 75 years old and digital computers were developed for military purposes towards the end of World War II, and only later were applied to non-military computations. Starting less than ten years ago, they said, digital computers were first applied to the solution of individual and mathematical problems arising from the design of electrical machines. These applications were limited to specific portions or phases of the design problem.

"The marriage of the still young electrical design art and the infant digital computer art," they said, "took place about five years ago. At that time two of the authors applied the IBM Card Programmed Calculator (CPC) to the entire design process and, by an automatically convergent procedure, were able to determine the constructional features which would meet the specifications. The first power transformer designed in this manner came of the Schenectady CPC in May, 1953. Similarly, the application of computers to the design of rotating machines was first discussed in 1954. Since that time, several papers have been written in this country on the subject of applying computers to electrical design and work is actively progressing in this new and promising field. The widespread use of digital computers for scientific, engineering, and data processing applications in Europe has lagged behind the United States."

Wireless Mike

A wireless microphone has been developed for the use of speakers and lecturers who have to move around a lot on the platform, reports *Electronics*. The microphone can also be used for radio and TV broadcasting.





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Reactor for Merchant Ship Goes Critical

The Babcock & Wilcox Company reported that criticality, or sustained nuclear fission, was achieved on Feb. 6 in an experimental reactor built near Lynchburg, Va. as an aid in developing the nuclear propulsion system for the *NS Savannah*, world's first atomic merchant ship.

Spokesmen for B&W, prime contractor for the vessel's propulsion plant, said that the reactor start up was "right in line" with the ship's design and construction timetable.

The test unit stands in a specially constructed bay of B&W's critical experiment laboratory in Lynchburg. It is equipped with numerous automatic safety controls. Among them is an interlock which shuts down the reactor immediately if personnel attempt to enter the test bay. Close observation of the fissioning reactor at other points of the laboratory is made possible, however, by a closed-circuit television system supplied by the Diamond Power Specialty Corporation.

Company officials said that the reactor will be operated during the next several months to check analytical calculations made in the course of designing the ship's propulsion plant.

Scheduled for completion in 1960, the *Savannah* will be powered by an advanced type of pressurized water reactor. The reactor plant will deliver a maximum of 22,000 shaft-horsepower. Estimates of the power plant's capability run as high as 350,000 miles on a single core loading of nuclear fuel.

Thread Metrology Labs are Opened

A new service to aid industry with fastener fit problems got under way on Feb. 10 when Standard Pressed Steel Co. opened the first two in a network of three screw thread metrology laboratories.

The completed facilities are in the Jenkintown, Pa., headquarters plant of the precision fastener manufacturer and at the Cleveland plant of a subsidiary, The Cleveland Cap Screw Company.

The third laboratory is opening in March at SPS Western—new West Coast division of the company nearing completion in Santa Ana, near Los Angeles, Calif.

The three nearly identical units will make available to precision industrial fastener users seeking its service more than $300,000 worth of the most advanced screw thread measuring equipment.

Goal will be to help industry meet steadily increasing demands for mechanical precision and to reduce production losses resulting from "needless" fastener assembly problems, according to SPS President H. Thomas Hallowell, Jr.

Power Conference To Open in Chicago

Economic comparisons of the use of various fuels in the near future will be considered at one of approximately 30 sessions comprising the program of the 20th anniversary meeting of the American Power Conference in Chicago Mar. 26-28.

Discussions at the fuels session will deal with the economics of transporting energy, fuel availability and future power demand, the outlook for high energy fuels, and the energy aspects of underground gasification processes.

In addition, four sessions will be devoted to various aspects of nuclear energy power applications.

The American Power Conference, which is sponsored by Illinois Institute of Technology, in cooperation with 14 other colleges and universities and nine professional societies, will be held in the Hotel Sherman.

Other subjects to be covered at one or more sessions will include high voltage transmission which will be discussed by a group of foreign scientists. operation of a commercial supercritical pressure steam electric generating station, generation, transmission, and utilization of electrical energy, use of pumped storage for hydroelectric stations, steam and gas turbines, and heating and air-conditioning.

The colleges and universities cooperating in the conference are Illinois, Iowa, Iowa State, Michigan, Michigan State, Northwestern, Purdue, Minnesota, Wisconsin, Texas A. & M., New York, California Institute of Technology, Georgia Institute of Technology, and Massachusetts Institute of Technology.

The cooperating societies, besides the Western Society of Engineers, are American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Institute of Mining, Metallurgical and Petroleum Engineers, American Society of Civil Engineers, American Society of Heating and Air Conditioning Engineers, American Society of Mechanical Engineers, National Association of Power Engineers, and Engineers' Society of Milwaukee.

Civil Engineering Show Slated for 1958

Plans for the second Civil Engineering Show, to be held in conjunction with the 1958 Annual Convention of the American Society of Civil Engineers at the Hotel Statler in New York, Oct. 13-17, have been announced by Executive Secretary W. H. Wisely.

The complete success of the society's first commercial exhibit in October, 1957 has prompted expansion of facilities to provide larger booths and double the number available in 1957.

Wisely said extension of the Civil Engineering Show will by no means reduce the traditional concentration on the ASCE technical program. Results of a poll conducted last year indicate those attending the convention felt that exhibits are a valuable adjunct to sessions sponsored by the 14 technical divisions.

ASCE, which has more than 40,000 members, and is the country's oldest national organization of engineers, customarily devotes the major portions of its conventions to papers and discussions relating to the technical and professional aspects of civil engineering.

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Technological Manpower

(Continued from Page 6)

portion of their time in less specialized work.

The third common problem was emphasized in every country we visited: the inadequate supply of well-qualified secondary-school science teachers. It was widely recognized that the quality of science teaching in secondary schools is of major importance in determining the number of graduates who have both the wish and the preparation to study science or engineering at university level. Equally it was recognized that the quality of science teaching in the secondary schools goes far in determining how well science and its place in modern society will be understood by future lawyers, journalists, government administrators, business executives, and other leaders whose attitudes and decisions are important both for the welfare of science and for the effectiveness with which a nation makes use of its technological resources and potential.

In most countries, we found that beginning secondary-school teachers are not paid as attractive salaries as are university graduates who enter medicine, engineering, and other professions. But this is not universally true, for in some countries the salaries offered to beginning teachers are reasonably competitive with those received by beginning engineers and doctors. In no country, however, are rate of advancement or maximum income as high as can be expected in other professions. Even so, it seemed to us, income is not the primary deterrent to securing the desired number of able secondary-school teachers. Other factors are involved.

Historically, the principal occupational opportunity for a university graduate in science or mathematics was as a secondary-school teacher. In recent years, industrial and research opportunities have attracted many graduates who formerly would have become teachers. These other jobs are not only more attractive financially, but more attractive also in the availability of better facilities, the opportunity to work with scientifically trained colleagues, and the opportunity to work in new, rapidly developing, and more glamorous positions. The result has been that the field of teaching has attracted a smaller and smaller fraction of new university science graduates, and there is a widespread feeling that teaching has too frequently been the field of choice of the less able and less ambitious of the new graduates.

Higher starting salaries can help restore the competitive position of secondary-school teaching, but higher starting salaries alone simply cannot do the job. It will also be necessary to revamp the salary schedule so that particularly successful teachers are rewarded for their excellence, instead of being held down to a standard salary scale. We must also pay attention to the nonmonetary factors and enhance the status of successful teachers if we are to recruit and to hold a larger number of able graduates for the teaching profession.

There are differences among the European countries, and differences between those countries and the United States, with respect to the relative income of teachers and with respct to the average quality of preparation of beginning teachers. Despite these differences, the importance of improving the quality of education in science at the secondary-school level and the importance of increasing the number of well-qualified science teachers was, I believe, the most frequently made single point by our consultants in Western Europe.

Perhaps the strongest impression of all that I developed in the course of our discussions in the European countries is that industrial developments are forcing all of the countries to think about essentially the same set of problems. Methods of meeting these problems must vary somewhat, for the educational systems, and the social organizations in which they exist, vary considerably from country to country. Yet the basic problems are similar, not only to the Western European countries, but to industrialized countries generally. They are, therefore, problems that are also of concern in the United States. Consequently, it is desirable for all of us to understand that we do have similar problems, that to a considerable extent our educational goals are alike, and that, given those similarities, we all have something to learn from the experience of other countries. I am sure that the organizers of this conference had this fact in mind in planning tonight's meeting.

And Rome Burned

In 54 A.D., Nero ate sherbet made by mixing snow from the mountains with fruit juices, pulp, and honey, reports *Food Engineering*. No wonder he fiddled so coolly while Rome burned.

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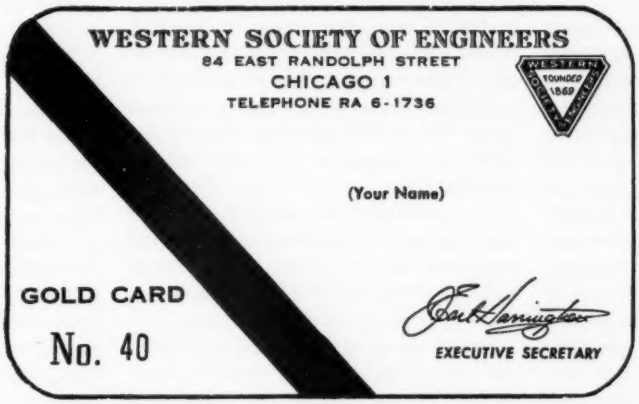

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Killian Receives Schooling Plan

A plan to increase the number of young teachers for engineering schools of the United States has been presented to Dr. James R. Killian, Jr., the President's Special Assistant for Science and Technology, by The American Society for Engineering Education.

To encourage more good students to enter graduate study, the period during which most engineering students discover their interest in a teaching career, the ASEE states that basic research in engineering must be expanded and that federal agencies supporting basic research in engineering should greatly enlarge both the number and the amount of the grants. The increased amounts adequately should cover the true costs, including the portion of the faculty salaries required to direct the projects. The contracts also should be for longer periods of time, such as five years, and should provide means for the construction or enlargement of the buildings required.

With this as a fundamental premise, the four-point plan is:

1. A substantial increase in the number of National Science Foundation fellowships for first-year graduate study in engineering.

2. A program of secondary grants to those who fail to qualify for full fellowships under the National Science Foundation program.

3. Supplementary federal grants to holders of National Science Foundation fellowships who take part-time teaching assignments.

4. A new program of awards under the National Science Foundation to increase the financial aid to graduate students who combine teaching with their education and research experience.

ASEE calls particular attention to the important role of basic research in preparing engineering teachers. Federal support of basic research, the Society's report states, "will determine the supply of individuals with the requisite background to educate engineers in an age when basic understanding of scientific principles must replace dependence on intuition and experience."

Until very substantial steps are taken to relieve the critical shortage of teachers, efforts to increase undergraduate enrollments are "highly questionable," says the Society's Committee on the Development of Engineering Faculties.

Already, the committee says, the U.S. faces a shortage of nearly 1,000 engineering teachers. About 9,500 new teachers will be required by 1966.

ASEE's program, says Dean William L. Everitt, MWSE, of the University of Illinois, who drafted the Society's recommendations to Dr. Killian, represents "an evolutionary but not revolutionary change in present federal policies.

"It would serve to increase the critically inadequate supply of well-educated engineers, and it would provide small additional incentives for a number of these to explore teaching careers."

Dr. Frederick C. Lindvall, president of the society and chairman of the Division of Engineering at California Institute of Technology, points out that academic careers are not the traditional ones for engineering graduates as they have been for most scientists. Therefore, he says, "graduate students in our engineering colleges need every opportunity and encouragement to sample the satisfactions of teaching and the real excitement of fundamental research."

Dr. Harold L. Hazen, dean of the Graduate School at the Massachusetts Institute of Technology and chairman of the ASEE committee, emphasizes that "The primary need is for more of our ablest recipients of bachelor's degrees in engineering to enroll in our residential graduate schools. It is from these graduate schools that our engineering teachers come."

The supply of resident students depends chiefly upon support in the form of fellowships and assistantships, Dean Hazen believes.

"Resident" graduate work is emphasized by the committee because, its recommendations say, "experience has shown that students who take graduate work on a part-time basis while employed in industry are almost never attracted to academic careers."

But many students who have an opportunity to teach engineering during their graduate years discover that they enjoy teaching and decide to make it their career. And all engineering educators agree that teaching is itself a most effective means of learning.

Indeed, say the committee's recommendations to Dr. Killian, every qualified engineering graduate student should have the opportunity and even obligation of assisting in his university's teaching program.

Wet Paint

An Upper Darby, Pa., worker demonstrated a handy way to paint a cable recently, reports *Chemical Week*. He filled a spongelike glove with paint, grabbed hold of the cable which supported a high-tension line, and slid down leaving a trail of paint. A line and pulley took him back to the top again so he could start on the next cable.

Elastic Paper

The next unusual new material for industry will be elastic paper, reports *Product Engineering*. The paper is not creped; the elasticity is built right into the fiber construction.

New Device Transmits Power

A patented new mechanism, called the Gyrotron, which has been termed one of the most unique converters of movement in existence today, has been unveiled by Girard Perregaux and Co. as the heart of the self-winding mechanism in their new Gyromatic 39 automatic watch.

The device, which now permits a transmission of power to the mainspring with no mechanical resistance will perform better, wear longer and require less service than its counterpart in other movements. The Gyrotron was noted in its recent introduction in Europe as, "A technical invention of ingenious simplicity."

Although no additional uses have yet been considered, the company says that its invention is applicable where a gear is used to transfer energy, since it converts a gear into a continuous freewheeling clutch. The company also states that the use of two Gyrotrons provides an automatic clutch and rotation inverser system, such as is used in the Gyromatic 39.

The Gyrotron has solved the problem of converting the motion of a swinging weight, or "rotor" into a unidirectional and continuous rotation without the mechanical resistances of clicks, springs and ratchets. Girard Perregaux has achieved this by replacing the latter components, which are subject to wear, with a free wheel clutch mechanism employing jeweled bearings, or "rollers," which are harder than steel and require no oiling. The Gyrotron gives the Gyromatic 39 a self-winding mechanism which will operate more efficiently for a longer period of time with no loss of power and wear and tear due to friction.

Dr. Lloyd Motz, professor of physics and astronomy, Columbia University, describes this development in his latest publication, "The History Of Time." He says, "We can understand why the Girard Perregaux device is superior to all others by comparing what happens when a man carries a weight up a flight of stairs, with what happens when he pushes the weight up an inclined plane of the same height. In the first case, he must do at least enough to carry the weight to the next higher step. If he does less than this, the weight will fall back . . . The Girard Perregaux mechanism is similar to pushing the weight up the inclined plane; however small an amount of energy is expended by the man, the weight will move a slight amount up the incline and finally come to the top."

Girard Perregaux explains the principle of the Gyrotron in this manner: its object is to obtain coupling as and when required, between two coaxial components—a disc secured to the arbor, and therefore rotating with it, the arbor carrying a pinion which transmits its motion to the mainspring; and a circular ring gear with teeth on its outer circumference. The ring gear is not connected directly with the disc which it drives; there are a number of formed notches on its inner surface, which are of trapezoidal shape, and in each notch a small jewel is lodged. There are seven jewels in each Gyrotron used in the Gyromatic 39.

The notch is not of uniform radial depth, with the dimension increasing progressively from one end to the other. When the roller is in the narrowest part of the notch, it is forced under pressure into contact with the disc, which is therefore coupled to the ring gear. This takes place when the latter is driven in a particular direction by a swinging weight. If the weight is going in the opposite direction, the ring is also turned in reverse, and each roller is forced to move to widest part of the notch, so that the disc now becomes free.

Two such Gyrotrons are employed in the self-winding Gyromatic 39 mechanism, to provide unidirectional movement to wind the mainspring at each swing of the rotor. The ring gears of the Gyrotrons engage with one another; one of the ring gears is in engagement with the pinion mounted on the swinging weight and the two Gyrotron gears therefore rotate in opposite directions. When the swinging weight turns clockwise, one of the ring gears drives the corresponding disc, arbor and pinion, which ensures that the barrel is rotated. The second ring gear, which is revolving in the opposite direction, turns freely.

When the swinging weight turns in the opposite direction, the second ring gear drives its disc and pinion, and now transmits motion while the first turns freely. In this manner, the mainspring is always wound in the same direction since the two ring gears are always moving in opposite directions.

According to Girard Perregaux, the Gyrotron is extremely simple in design. Its inventor is M. Jean-Pierre Graef of Girard Perregaux, La Chaux-de-Fonds, Switzerland.

Automatic Crane

By recording preselected operations onto a recording tape, overhead traveling cranes engaged in repetitive duties, can now be run without an operator, reports *Electronics*. The system consists of a tape recorder, frequency generator and frequency selector panels and a control panel to provide automatic operation.

Spectacular

Grand Coulee will resort to color in an effort to lure back lost tourist business, reports *Electrical World*. Next Fall, clusters of colored lights will create a "Spectacular" that Washington State hopes will boost the sagging tourist interest.

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C-6710 SR. INDUSTRIAL ENGR. BSIE or ME from accredited college, age 26-35; 5+ yrs. industrial engrg. exp. with recent wage incentive administration. Duties: General indust. engrg. duties incl. wage incentives, standard costs & cost reduction, policy manuals, methods, materials handling, warehousing, etc. sal. to $8400 loc. Chgo. employer will pay the fee.

C-6711 FIELD & OFFICE ENGR. Grad. CE age 30+; 5+ yrs. in municipal design & construction. Duties: Office & field work on park planning, swimming pools, recreational facilities, etc. Good personality able to meet & talk with village boards. Good potential sal. $7200+ loc. No. Shore Chgo. suburb, employer will negotiate the fee.

C-6712 DESIGN & DEVEL. Elect. & Electronic Engr. Grad. EE with exp. in high power (megawatt) high volt. pulse techs. & design of radar modulators; exp. in high power frequency industion heating eqpt. des. & devel. desired. Duties: Design & devel. high power modulators & pulse generators. sal. up to $650 mo. loc. Chgo. employer will pay the fee.

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865-MW: STRUCTURAL ENGR. 47 Civil Engr. Struct. Engrg. Bus. Admin. 30 yrs. heavy & light construction design & field engr. Public works, power plants, factory bldgs., highways, waterways, commercial bldgs. $15,000 Chgo. Met. Area.

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868-MW: SALES MGR. (process indust. eqpt.) 46 BS Ch.E. 8 yrs. in direct sale of corrosion resistant plastic eqpt. 2 yrs. sales mgr. corrosion resistant metals. 8 yrs. heat insulation materials sal. $14,000.

869-MW: ELECTRONIC ENGR. (radar) 28 BSEE extensive radar exp. in GCA & assoc. fields. 8 mos. exp. in radar electronic counter measures, 80 wks. teaching exp. GCA exp. in modifying radar sets $7200.

Plants Need Corrosion Engineers

The need for a corrosion engineer in industrial plants large enough to warrant one, was emphasized in Chicago on Dec. 11 during a symposium on the subject at the Annual Meeting of the American Institute of Chemical Engineers. Four papers on the subject comprehensively reviewed the problem and suggested numerous steps to prevent or reduce corrosion damage.

John Halbig, Research Laboratories, Armco Steel Corporation, Middletown, Ohio, told the symposium that ". . . every plant of large enough size should have at least one engineer keep in touch with developments in the corrosion field. An important part of the plant engineering staff's duties should be to keep abreast of published data and current investigation work. This can be accomplished through technical society publications, committee activities and symposia, and through participation in interplant symposia, local corrosion control activities, supplier sponsored technical meetings and university short courses.

"There will be times when the plant corrosion engineer will not have all the information he needs in order to cope with a problem. He should realize that many suppliers of materials of construction have research organizations and/or large technical staffs. This should be his first approach for assistance."

In a general review of the corrosion problem, Mars G. Fontana, Ohio State University, in a paper titled "Corrosion and its Manifestations," pointed out that "Too many design engineers seem to take great delight in making parts of as many different metals and alloys as possible. This results in many costly failures that could have been easily avoided." He said that in the design of structures, "equipment life can be prolonged or corrosion costs can be reduced through the use of bottom outlets designed to drain completely, readily replaceable or interchangeable parts, standard lengths of tubing, increased thickness in more vulnerable areas, designing to prevent crevices or stagnant areas, and the use of butt-welded instead of riveted joints".

In a paper, "Copper Alloys for Corrosion Resistance," Randolph V. L. Hall, Bridgeport Brass Co., Bridgeport, Conn., said that copper alloys are being used increasingly to protect other alloys from corrosive conditions, the performance of which alloys is unpredictable, while the performance of copper alloys is predictable.

"As we learn more about the exact conditions in which the various alloys and metals give the best performance," he said, "it should be possible to select combinations of duplex or clad metals which will be economical from the standpoint of long and trouble-free service life. The copper alloys will certainly have their place in this picture because of their generally good corrosive resistance to a wide range of corrosive chemicals, particularly under non-oxidizing conditions."

In a paper, "Stainless Steels for Corrosion Resistance," L. R. Honnaker, DuPont, Wilmington, Del., observed that "the general resistance of stainless steels is only part of the consideration that should be given to the selection and use of stainless steels for chemical process equipment. It is important to consider the possibility of other factors causing unexpected difficulties. Design features that will insure free drainage, ease of cleaning, and elimination of crevices will help to avoid pitting and crevice corrosion. Where acidic conditions are to be handled above ambient temperatures, consideration should be given to the necessity and means of avoiding intergranular corrosion. Finally the nonprocess or external environments should be considered, particularly with respect to failures by stress-corrosion cracking."

Mr. Honnaker pointed out that stainless steels are widely used for process equipment in the chemical industry and in the past 25 years considerable data have been compiled, and as a result of this knowledge, failures due to general corrosion are infrequent.

He said that development of fundamental information on the nature of passivity and corrosion resistance is continuing and "there is good reason to believe that stainless alloys of slightly modified compositions having improved corrosion resistance will be available soon."

Reviews of Technical Books

Heat Transfer

Heat Transfer, Volume II, John Wiley & Sons, Inc., New York 16, N.Y. 1958. Pages, 652. Price, $15.00.

Primarily concerned with applications, this new book supplements Volume I (1949, $13.50) which is devoted mainly to theoretical concepts.

This second volume follows the formal organization of the earlier book, continuing the text with Part F: two chapters on heat radiation in spaces of simple configuration. In Part G, selected applications are covered under the following headings: heat transfer in thermometry and related branches of measurement; ordinary heat exchangers (recuperators); regenerators; cooling towers; cooling by falling liquid films; cooling of surfaces exposed to hot gases; heat transfer through laminar and turbulent boundary layers at high fluid velocity; heat transfer in liquid metals; and steady-state heat transfer in packed columns. Part H constitutes a set of extensive supplements to Volume I, bringing all the earlier material up to date.

Volume II was completed with the technical and editorial assistance of Stothe Peter Kezios, associate professor of mechanical engineering at the Illinois Institute of Technology. The late Dr. Jakob was long associated with the Institute where he was research professor of mechanical engineering. He was also a consultant in heat transfer to the Armour Research Foundation and Purdue University.

Motion and Time Study

Motion and Time Study, by Ralph M. Barnes, John Wiley & Sons, New York 16, N. Y. Fourth edition, 1958. Pages, 665. Price, $9.25.

Ralph M. Barnes has again brought this work up to date, and the volume appears in thoroughly modern form with considerably more text and fresh illustrations.

Dr. Barnes adheres to his original purpose: to offer the principles underlying the successful applications of motion and time study, each supplemented with illustrations and practical examples. His latest research has resulted in five new chapters dealing with motion study, mechanization, and automation; mechanized time study and electronic data processing; systems of motion-time data; evaluating and controlling factors other than labor; multi-factor wage incentive plans; and work sampling. The last of these concisely states the best practice in the field and includes charts, tables, and other data needed to put work sampling to actual use.

The present edition also contains new material on developments in the industrial use of pulse rate as an index of physical activity, as well as the latest information on statistical procedures in time study, and on auditing methods, time standards, and wage incentive plans.

As *Motion and Time Study* now stands, all known systems of motion-time data are outlined, four of these described in some detail and including complete tables of data for each. The author's work is enriched by his periodic surveys of industrial engineering practices in the United States, the latest survey made in 1957.

Dr. Barnes is professor of engineering and production management at the University of California in Los Angeles.

Ceramic Fabrication

Ceramic Fabrication Processes, edited by W. D. Kingery, John Wiley & Sons, Inc., New York 16, N. Y. and the Technical Press of the Massachusetts Institute of Technology, Cambridge, Mass. 1958. Pages, 235. Price, $9.50.

Ceramic Fabrication Processes is an outgrowth of the 1956 Special Summer Program in Ceramics held at the Massachusetts Institute of Technology. The new book represents the combined knowledge of 22 specialists who provide details on both the technical basis and present practice in the field.

The authors cover the full range of current and potential developments, combining traditional and novel ceramic fabrication methods for the first time. Six general areas are included: slip casting; pressure fabrication; plastic forming; drying and firing; some special processes; and ceramic microstructures. The coverage for each fabrication step includes forming, firing, and the resultant properties as affected by fabrication. A comprehensive guide to the selection and use of fabrication techniques, the volume is applicable to new high-temperature materials, ferrites, ferroelectrics, and other special ceramics, which are particularly important to the development of electronics.

Testing and Chemistry

Qualitative Testing and Inorganic Chemistry, by Joseph Nordmann, John Wiley & Sons, Inc., New York 16, N. Y. 1958. Pages, 488. Price, $6.25. Developing the subject for both lecture and laboratory, the author emphasizes the best of qualitative analysis and adds general related chemistry.

A practical approach characterizes the volume, with a lengthy chapter devoted to special experiments. Analytical chromatography, electrography, experimental determination of equilibrium constants, and chemical microscopy are among the experiments demonstrated here. Two other important chapters cover organic analytical reagents, and chemistry and analysis in common alloys and matrixes of W, Mo, Ti, V, Zr, Be, U, and Li.

Nordmann accords a thorough treatment to elementary chemical equilibrium, and explains experimental methods for determining the physical constants used in calculations. He provides sections on blow pipe analysis, dry fusions, and bead and flame tests, and reviews equation writing, mathematical manipulations, and expression of solution concentrations. Throughout the volume, involved problems in calculations are worked out within the chapters, while a large number of problems appear at the end of each chapter.

Accelerator to Operate Soon

What happens during a chemical reaction that is catalyzed or set off by atomic radiation? With the help of a new research tool, a high energy electron accelerator, scientists at Argonne National Laboratory, Lemont, Ill., will seek an answer to that question. The accelerator is expected to be in operation this fall.

They hope to detect directly the short-lived intermediate products of radiation catalyzed reactions. Knowledge of these primary products and their basic reaction mechanisms, they feel, will help science better protect living organisms from radiation effects. This knowledge also may enable scientists to use radiation better to preserve foods and to produce new chemical products.

Applied Radiation Corp., Walnut Creek, Calif., is building the linear electron accelerator for Argonne. It will emit intense bursts of electrons, creating short-lived bits of matter such as ions and free radicals in sufficient concentration to allow their direct identification.

Argonne scientists also plan to use the accelerator to study radiation damage and nuclear chemistry.

For decades it has been known that high energy electrons and gamma rays induce chemical reactions, but exactly what takes place is still open to question in most cases. With the exception of dilute gases, information about the short-lived intermediate products involved has largely been deduced by working backward from the end products. Or information has been obtained from reactions that involve substances such as iodine that scavenge, or pick up, free radicals.

While useful, scientists say, these techniques are not definitive. There is disagreement concerning the nature of even some of the more well-known reactions.

With the help of the new linear electron accelerator, Argonne scientists hope to make a direct frontal attack on this problem—directly identifying the chemical intermediates.

Linear electron accelerators emit intense bursts of electrons. According to Dr. Max S. Matheson and Dr. Leon M. Dorfman, Argonne chemists, "With an intense pulse of high energy electrons, short-lived intermediates such as radicals or ions may be produced in such concentrations as to be directly observable."

Transients in radiation chemistry are to be studied in techniques similar to those now used in flash photolysis, a process in which small amounts of a chemical are subjected to intense bursts of light so that very fast reactions may be studied. Solid, liquid, and gaseous systems will be studied with this method utilizing bursts of electrons.

During a pulse, the Argonne accelerator will emit a 280 milliampere beam of electrons, 1,800 million billion electrons per second. Electron energy will be controlled from 1 to 18 million electron volts.

For continuous operation the electron beams of most high power accelerators are scanned or diffused over large areas to avoid melting the metal windows through which the beams leave the accelerator. By means of a specially designed exit window, it will be possible to extract a 1 centimeter diameter beam without scanning. Therefore, the full beam can be directed into a small experimental system.

On the order of 200,000 rad (the unit of absorbed dose, a measure of energy imparted to matter by ionizing radiation per unit mass of irradiated material) can be administered to a sample in a single pulse 6 millionths of a second long. Pulse rate will be varied from a single, manually fired pulse to 800 cycles per second. The 15 foot long accelerator, powered by a single 5 megawatt klystron (high-power microwave oscillator), cost $225,000.

Argonne plans to use the accelerator to pursue studies in radiation damage and nuclear chemistry as well as in radiation chemistry. Using electrons, Argonne scientists will study the character of radiation damage in which the displaced atoms are isolated and will investigate to determine the critical (or minimum) energy needed for atom displacement.

To permit the latter, the accelerator includes a magnetic spectrometer which allows irradiations with monoenergetic electrons (electrons having the same energy and velocity) over the entire energy range. Transuranium photofission processes will also be studied, and other photonuclear reactions will be examined in many elements.

Argonne National Laboratory, the nation's senior atomic energy research and development installation, is operated by the University of Chicago, under contract to the U.S. Atomic Energy Commission. Located 25 miles southwest of Chicago, Argonne serves as a center for both basic research and reactor development. Work of the Laboratory deals with peacetime applications of atomic energy.

Applied Radiation Corporation, formed 4 years ago by physicists and engineers formerly with the University of California Radiation Laboratories, specializes in the development and manufacture of accelerators for both research and commercial radiation processing. Half interest in the Corporation is owned by Archer-Daniels-Midland Company, Minneapolis-based processor of chemicals, agricultural and marine products.

News of Engineers

Edward Schaschl and G. A. Marsh, in the Research and Development Laboratory of the Pure Oil Company, Crystal Lake, Ill., have been designated to receive the 1957 Young Author Award of the National Association of Corrosion Engineers. Their paper, "The Effect of Dissolved Oxygen on Corrosion of Steel and on Current Required for Cathodic Protection," published in the April, 1957 issue of CORROSION, was considered most meritorious among 52 papers competing.

The Young Author Award, made annually for the best paper published during the year in the NACE monthly periodical CORROSION, by an author under 35 consists of a $50 gratuity. The award was established by an anonymous donor in 1953. Maximum age of authors eligible for papers published during 1958 and subsequent years has been reduced to 30 years, to encourage writing of corrosion control papers by young researchers.

The awards will be presented at the annual banquet of NACE at San Francisco, Wednesday, March 19, during its 14th Annual Conference and Exhibition.

* * *

Clifford F. Hood, president of United States Steel Corporation, has announced in Pittsburgh, Pa., the appointment of two executive vice-presidents and a realignment in the responsibilities of two other executive vice-presidents. These changes are effctive immediately.

Walter F. Munford, who has been assistant executive vice-president — operations, becomes executive vice-president—engineering and research, and R. Conrad Cooper, who has been vice-president — administration planning, becomes executive vice-president—personnel services.

A change in the responsibility of M. W. Reed, now executive vice-president—engineering and raw materials, to executive vice-president — international and raw materials, involves the consolidation of corporation interests in international commercial matters into a new international and raw materials department. H. B. Jordan, who has been executive vice-president — operations, becomes executive vice-president—production, more properly signifying the broadened executive function relating to steel production, fabrication and manufacture.

George W. Rooney continues as executive vice-president—accounting and R. F. Sentner continues as executive vice-president—commercial.

Mr. Hood in making the announcements said: "These changes recognize the close relationship between research and facility planning, as well as the association between current raw materials operations and foreign markets. The organization of a personnel services department under one responsibility recognizes the close interrelationship and the growing importance of the human relations factors in labor relations, organization planning, personnel, and compensation."

* * *

Walter P. Marshall, president of Western Union, has announced the designation of J. Z. Millar, assistant vice-president, Development and Research, to head sales of the company's technical services and equipment, in addition to his present duties.

In Western Union laboratories at New York City and Water Mill, Long Island, many of the nation's leading communications engineers are constantly developing new and better electronics equipment and systems, which in many cases find broad application outside the company's own operations. While Western Union has carried out a great variety of research and development projects for the government and the military, it will be Millar's objective to make these new developments, and Western Union's scientific and engineering personnel and laboratories, available on an even broader scale than in the past as an aid to the national defense.

Millar will be responsible for all matters involving contracts for the sale of technical services and equipment to the government, armed forces and industry, and will coordinate the activities of all company representatives engaged in sales and contractual matters in this general area. Marshall stated that the company's Sales and Services Department will continue to be responsible for the leasing of private wire and facsimile systems, covered by established tariffs.

Western Union has acquired substantial holdings in a number of young and growing companies which enjoy outstanding reputations in the microwave, electronics, nucleonics, television, aerodynamics, closed circuit television and other fields. This has made available to Western Union the advice and cooperation of some of the nation's outstanding scientists and engineers specializing in associated fields, and supplementing the company's own research and development forces. Millar is a director of three of these companies, Microwave Associates, Inc., Technical Operations, Inc. and Dynametrics Corporation.

Upon completion of his electrical engineering education, Millar began his career with Western Union in 1923 as an engineering apprentice at Washington, D.C. He was transferred to Western Union's electronics research laboratories

at Water Mill, L.I. in 1926. After specializing on high-frequency radio methods and wire line transmission systems for 15 years, he was called to active duty to the U. S. Signal Corps, in which he attained the rank of colonel. He headed the Signal Corps Board at Ft. Monmouth, N.J., and was later Signal Officer, Normandy Base Section, and Signal Officer, Loire Section, European Theatre.

At the end of the war, Millar was appointed radio research engineer of Western Union and organized that division of the Development and Research Department. He became director of research in 1949 and was appointed assistant vice-president in 1953. He is a fellow of the Institute of Radio Engineers.

* * *

Frank M. Fucik, president of Water Seals, Inc., manufacturers of Labyrinth plastic waterstops, participated in a government-industry conference on Feb. 5, at the Office of the Chief of Engineers, Corps of Engineers, U.S. Army.

The meeting, held in Washington, D.C., consisted of discussions relating to future specifications of plastic waterstops for use in federal projects. Waterstops are commonly used between successive concrete joints to prevent water seepage and moisture damage to the concrete.

Fast Shutter

A chemical camera shutter that will permit exposures as short as five billionths of a second is being developed, reports *Product Engineering*.

Proximity Switches Do the Impossible

Automation in industry has resulted in a practical application of the flip office adage: "The difficult we do immediately, the impossible takes a little longer."

The difficult and impossible are now being done by proximity switches which operate machines that cannot be controlled in any other way, an industrial control symposium was told in New York on Feb. 5 during the Winter General Meeting of the American Institute of Electrical Engineers. They have application in industries ranging from beer brewing to steel making, F. A. Manners and R. C. Mierendorf, of the Square D Company, said in a paper, "Proximity Switches—Characteristics, Design and Application."

They pointed out that such switches have been used in packing of aluminum foil to detect the absence of cutting edges on cartons; in beer brewing to detect the presence of cans in supposedly empty cartons, and in the steel industry to facilitate the fabricating of tubing.

Proximity switches have found numerous applications where conventional mechanical switches have not been applicable, they said, adding that "As requirements of automation demand more and more reliability as well as the usual feedback information, proximity devices capable of versatility must be made available to meet these demands. Their use is recommended to complement existing limit switches in order to arrive at the most effective system design."

Automation requires that the machine and its controls operate as an integral whole, they said, adding that "The complexity of the function performed and the intimate interrelationship between machine and control make it essential that these new control systems be designed as carefully correlated combinations of sensing, logic and output elements, and with the end requirement of the final operation in mind at all times.

"The resulting more critical look at the control design problem has produced notable advances in all branches of the science, including the reduction to practice of some entirely different philosophies of basic approach hitherto untried to any significant extent."

Surveys by larger users of machine tools have pointed up the magnitude of the input problem, they said. "Coordinating (logic) and output elements such a relays and starters are responsible for only some 10 per cent of system failures and down time. The great majority of the problems are traceable to the input devices and purely mechanical problems. There is little question that the trend will continue strongly in this direction since the compounding of complexity occurs primarily in the input, sensing and feedback portions of the control.

"Even with simpler control systems the greatest amount of difficulty arose from the misapplication of conventional sensing devices. By now, to this already serious problem has been added the increasing complexity of requirements which conventional devices in many cases are incapable of satisfying at all. It has now become evident that numerous previously 'difficult' applications, as well as many of the new 'impossible' applications can be satisfactorily handled only by the substitution of proximity inputs for conventional limit switches."

Photoelectric Device May Ease Bus Jams

A photoelectric scanning device may soon ease bus jams in London, reports *Electronics*. A ray from a bus will be picked up by a lamp-post mounted scanner. The signal is then amplified and the information about buses relayed to a control panel. Extra buses may be sent out, or routing instructions telephoned to dispatchers to avoid bus bunching.

WSE Applications

In accordance with Article I, Section 5 of the By-Laws of the Western Society of Engineers, there is published below a list of applicants for admission received since the last issue of the MIDWEST ENGINEER magazine.

Oliver H. Millikan, Civil Engineer, Joseph H. Knoerle & Associates, Inc., 155 N. Wacker Dr.

George D. Butler, Assist. Elect. Engr., City of Chicago, Bur. of Elect., City Hall.

W. J. Denton, Elect. Serv. Suprvr., Westinghouse Electric Corp., Merchandise Mart.

S. D. Ginsberg, Hydraulic Engineer, U. S. Corps of Engineers, Merchandise Mart.

Frank J. Jakoubek, Pres. & Gen. Mgr., Star Jack Co., River Grove, Ill.

Thomas Kilduff, Supt. & Engineer, City of Chicago, Bur. of Elect., City Hall.

Henry P. Walsh, Senior Civil Engr., Metropolitan Sanitary District of Greater Chicago, 100 E. Erie St.

Howard C. Hardy, Owner, Howard C. Hardy & Associates, 22 W. Madison St.

William J. Gedzun, Proj. & Des. Engineer, Joslyn Manufacturing & Supply Co., 969 W. 37th St.

George M. McCarthy, Rotational Trainee, Illinois Bell Telephone Co., 212 W. Washington St.

Jack N. Springer, Supervising Serv. Engr., Westinghouse Electric Corp., Merchandise Mart.

Louis A. Kemnitz, Supervising Engr., Illinois Bell Telephone Co., 208 W. Washington St.

A. Rychalski, Design-Estimator, American Bridge Div., U. S. Steel Corp., 208 S. LaSalle St.

Nick Gaudio, Chief Engineer, Chicago Design Service, 2068 N. California Av.

Ross Dickson, Vice President, W. D. Allen Manufacturing Co., 566 W. Lake St.

Harry Joseph, 3254 S. Michigan Av.,— attending Illinois Inst. of Tech.

Richard J. Okon, Sales Manager, W. D. Allen Manufacturing Co.. 566 W. Lake St.

Miss May M. Benson, Owner, Benson Tube Industries, 3240 W. Irving Park Blvd. (Rein.)

Superconductivity is Used in Memory Unit

Low temperature physics research work being conducted by The Ramo-Wooldridge Corporation has resulted in the development of a very high speed computer memory element which makes use of low temperature superconductivity principles to achieve both storage of information and instantaneous switching.

The newly-developed device is called a "Persistor," and is a miniature bimetallic, printed circuit which operates at a temperature within a few degrees of absolute zero (minus 459.6 degrees Fahrenheit). It requires very little power for operation and has been designed with switching times as short as 10 millimicrosecond (1/100 millionth of a second).

The Persistor was designed for use in the "memory" unit of an electronic computer, and improves the access time to the memory 10 to 100 times over present methods. This increase in speed permits an improvement in balance between the arithmetic and memory units in the computer.

The Persistor was developed in the Ramo-Wooldridge Aeronautical Research Laboratory, headed by Dr. Milton U. Clauser. Inventor of the Persistor is Dr. E. C. Crittenden, Jr., and research on the project was carried out by Dr. Crittenden and Dr. F. W. Schmidlin.

The new unit makes use of the superconductivity phenomenon exhibited by various metals at low temperatures in order to achieve both the switching and signal storage functions required of a computer memory element. Essentially, the Persistor is a loop composed of segments of two metals, both of which are maintained in a superconductive state at a very low temperature. One segment of the loop is of a metal so chosen that the passage of a small current (the critical amount depending on its temperature) through it causes it to change from its superconductive to its normal resistance state. A subcritical current is induced in this loop and continuously circulates around it for an indefinitely long period, the direction of this current representing the information being stored.

Direction of the current in the loop is determined at any time by impressing an interrogating current pulse on the loop. The direction of the current in the Persistor is clearly indicated by the presence of a voltage pulse upon interrogation.

"Maintaining the low temperatures required for Persistor operation offers no obstacle to their immediate use in computers," Dr. Clauser says, "Recent advances in helium liquefiers make it feasible to maintain low temperatures at a cost which can be considered a negligible part of the cost of operation of a computer." Half a million Persistors will be able to operate in the space of only one cubic foot in a computer.

Dr. Clauser said that the company intends to continue its research into the low temperature physics.

Cryogenics—a New Tool for Industry

American industry is expanding its use of a dramatic new tool—cryogenics, the use of extremely low temperatures—which shows strong progress to date and bright promise for the years ahead.

Reducing the cost of cryogenic processing has been a major contribution of 17-year-old Air Products, Incorporated of Allentown, Pa. The latest Annual Report of Air Products shows a steadily rising sales curve, evidence of increased application of very cold processes in all phases of industry and in the missile program. Only two years ago, Air Products sales were at the $10 million level. This year, sales volume is just under $35 million and shows signs of continuing this sharp climb.

Extreme low temperature processes are at the root of the nation's recent expansions in the iron and steel industries, in the synthetic fertilizer industry, in providing liquid fuels for rockets and guided missiles and in wide-spread areas of the mighty, diversified chemical industry.

Low temperature research is supplying the nation's scientists more vitally needed data about the fundamental properties of matter, drastically needed to expand our country's position in the world race for scientific and technological leadership. Specific examples of the newest developments lie in the fields of electronic computers and atomic physics. In electronics, the superconductivity of materials at temperatures approaching absolute zero (460° below zero F) makes possible new designs permitting computer performance hitherto unexpected. In nuclear studies, liquefied gases provide concentrated targets for particle bombardment, enabling scientists to develop quantitative information about the behavior of atomic particles in motion.

In the petrochemical industry, the efficient production of high purity gases such as oxygen, nitrogen, hydrogen, carbon monoxide, methane, and others have made possible new products and processes for producing antifreeze, fertilizers, plastics, motor fuels, pharmaceuticals and synthetic fibers.

For the steel industry, high quality oxygen, 99.5 per cent pure, is made available at a cost per pound less than coal or crushed rock. This oxygen improves the iron productivity of blast furnaces, enlarges the steel capacity of the open hearth and is used in removing surface defects to improve the quality of finished steels. A new process, known as the top-blown Bessemer, or L-D converter, replaces the open hearth at dramatically low capital and operating costs. Other metals producing industries such as copper, also show promise for application of oxygen.

The missile program today employs extremely large quantities of liquid oxygen in fueling missiles such as the Army's Redstone and several advanced prototypes of the ICBM. Air Products produces over 90 per cent of the liquid oxygen employed in the government's missile testing program.

For advanced missile bases, Air Products has designed and built numerous mobile liquid oxygen plants which may be transported to an advanced missile base and in a few hours produce liquid oxygen for a missile launching. Thus, military logistics are considerably simplified. A missile battery may require only "hardware" and a single fuel, perhaps kerosene or other hydrocarbon. Part of the fuel is used directly in the missile, and part is used to make "LOX" (liquid oxygen), the missile-born oxidizer for the hydrocarbon fuel.

Index of MIDWEST ENGINEER *Advertisers*

Foreign Engineer Opportunities

Working in an office overlooking the Rue de la Paix, the Ginza or Picadilly Circus may sound exotic, but there are often more drawbacks than enticements in these jobs. In a special report, *Product Engineering* gives a country-by-country analysis of the opportunities and conditions that will be met by engineers who want to work abroad.

Australia has a strong demand for engineers not over 45, but salaries are low. Wages of $100 a week are on the high side. Specialized engineers can command more. Food, accommodations and entertainment are cheaper than in the U.S. Cars, appliances and other durables are substantially more expensive.

Argentina mainly looks for the product engineer, with experts in industrial organization, refining, electronics and steel furnaces next in demand. Most Argentine firms prefer a European engineer because he is easily satisfied with living conditions. Salaries range from $110 a month for a young Argentine to $1,000 a month for a top-notch imported engineer.

Brazil needs specialists in all phases of mechanical, electrical, chemical, atomic and plastic engineering. Only civil engineers are not short in supply. Salaries are considered high, but inflation makes savings hard. If an American wants to be a "registered engineer," and many companies insist upon it, he must pass an examination in Portuguese.

England: The status enjoyed by the engineer in Britain is slightly lower than in the U.S. A graduate engineer can expect to start at between $1,500 and $2,100. With ten years' experience he will get $4,400. The ceiling is around $15,000 for a technical director. As a result of this poor salary and status picture, an American production engineer can get a job in almost any English factory.

France has an engineering shortage, but it is not easy for an American to get a job. American firms operating in France must show a ratio of nine Frenchmen for every American employed. Best opportunities lie in the mechanical field. Electronic, chemical and petroleum engineers are in slightly less demand, but the future is bright. Need for nuclear engineers will double in the next few years while the demand for chemical engineers will increase by 30 per cent. France's greatest need is for the technician. Average salary with an American company is high—$10,000 to $15,000 per year.

Germany has demand for both mechanical and electrical engineers. Any American engineer going to work in Germany will have to reduce his living standards. Cost of living is a good third cheaper than in the U.S., but average salaries range between $2,300 and $3,500 annually. The electronics industry pays higher.

India: Opportunities exist with American firms operating in India, government agencies needing consultants, and the large Indian engineering and chemical firms. Greatest demand is for mechanical, electrical and construction engineers. In general, the "less expensive and more adaptable" Europan engineers have been getting preference. An engineer can expect a salary of 30 to 50 per cent higher than for an equivalent job in the states. In addition, there are benefits which could include rent-free furnished home, entertainment allowance, car or car allowance, profit-sharing bonuses, and a paid home-leave for the family after two and a half years. American firms figure a minimum salary of $10,500 annually, Indian firms less.

Italy: Petroleum and mining engineers are most in demand, but employment possibilities do exist in the electrical, chemical, metallurgical and mechanical fields. The Italian engineer just out of school will get $250 to $300 per month, sufficient for comfortable middle-class living for a family of three. Salaries for the more experienced engineer are higher. Cost of living in Italy is about a quarter cheaper than in the states.

Japan: The three fields open to an engineer are road building, irrigation and electric power projects. Most American engineers are obtained under technical assistance agreements with U.S. firms, and usually get a living allowance in addition to their American salary. An independent engineer would have to bargain with the employer, who would probably pay an American salary, provided the engineer has more to offer than his Japanese counterpart. Otherwise his salary would be $100 a month. Cost of living is about the same as in the U.S.

Sweden at present has a pronounced shortage of design engineers, particularly in the machinery and electronic fields. The American engineer will get an average monthly salary of about $300 for routine design work and up to $600 for a design-management job. Taxes are high, but cost of living is about half that in the U.S.

Mechanized Caddy

A mechanized caddy that brings up the golf club needed just by dialing its number is due on the market soon, reports *Product Engineering*. The club handles are clipped to an axial tube inside a cylindrical container; their heads rest in two rubber bowls, one for irons, the other for woods. When the dial lever is turned, the tube revolves and the desired club appears in the lengthwise opening on the side of the container. The device, when made of aluminum, is lighter in weight than a conventional bag.

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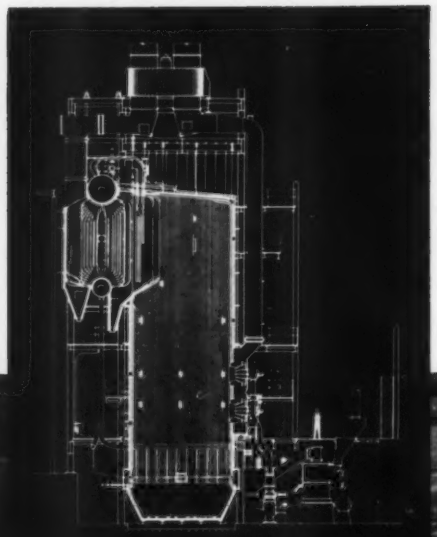
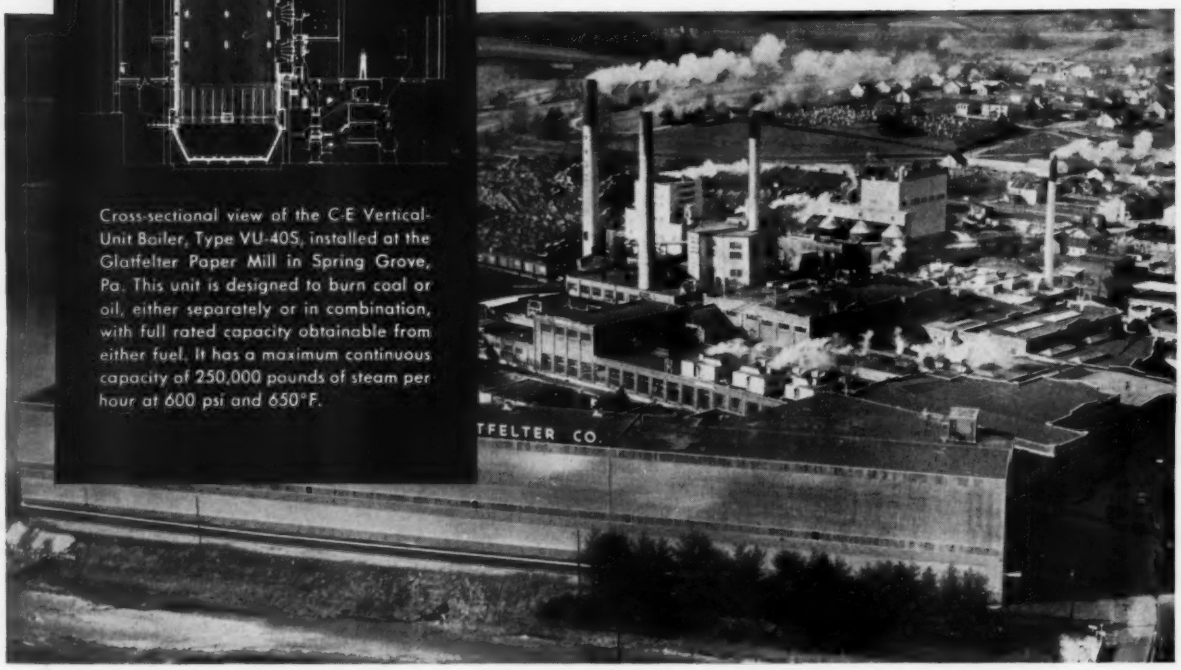
C-E BOILER "Makes a hit" AT NEW GLATFELTER PLANT



Cross-sectional view of the C-E Vertical-Unit Boiler, Type VU-40S, installed at the Glatfelter Paper Mill in Spring Grove, Pa. This unit is designed to burn coal or oil, either separately or in combination, with full rated capacity obtainable from either fuel. It has a maximum continuous capacity of 250,000 pounds of steam per hour at 600 psi and 650°F.



The recent start-up of this new paper mill marked the completion of the P. H. Glatfelter Company's largest expansion in its 93-year history. Included in this expansion was a new Fourdrinier paper machine, a 177-acre lake, and a C-E Vertical Unit Boiler. This new mill, which is in the best tradition of modern industrial architecture, has a potential capacity of over 300-tons daily.

Consulting Engineer tells why . . .

After completion of Acceptance and Peak Load Tests on a C-E Vertical-Unit Boiler, Type VU-40, at the P. H. Glatfelter Company's new Spring Grove, Pennsylvania, paper mill, The H. M. Wilson Company, Consulting Engineers of Philadelphia, commented as follows:

"Now, having determined the results of the tests, we are happy to advise you that the overall performance of the boiler was excellent, and we feel that this particular boiler is of outstanding design and construction. We have previously commented on the excellent cooperation of your Engineering Department in the design and development of this boiler, and can only reach the conclusion that your entire organization has been most cooperative and has done a fine job."

This opinion finds added significance in a statement by the company president, Mr. P. H. Glatfelter, III, who states, "We are well pleased with our choice of this C-E boiler for our new plant."

We, of course, are proud of this boiler, which, like the many other C-E installations of this and other types, is proving its superiority under actual operating conditions. When *you* need boilers, remember that Combustion Engineering has a complete line of steam generating and fuel burning equipment—a size and type that will meet your requirements exactly.

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